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development." An apparent climax, short of the true regional climax, is termed a subclimax.

The chapter in which the views of the author and the reviewer clash most sharply is the one on direction of development. CLEMENTS states positively that "succession is inherently and inevitably progressive." The reviewer is as positive in his opinion as ever that succession may be retrogressive as well as progressive, although of course progression is much more abundant and important. What the reviewer would term retrogression is for the most part by CLEMENTS termed denudation, preparatory to the initiation of another successional series. This might pass, if all such denudations or retrogressions were sudden, resulting at once in the development of a habitat initial to a progressive series. In an area that is gradually sinking, there may be a gradual retrogression from a climax mesophytic forest to a hydrophytic association, with no denudation of any sort whatever. In a review of CLEMENTS' work by TANSLEY,[2] it is shown that it would be very difficult to apply to England the idea that succession is always progressive.

Chapters follow on the classification of "seres," the climax formations of North America, past climates and climaxes, and past succession. The chapters on past climates and vegetation will be of great value, because they bring together compactly results from widely scattered sources. The theories and the applications of the author's views to the past seem very tenuous. It is difficult enough to apply ecological principles to the vegetation of the present, and it is very much too soon to work out the characteristics and successions of past floras in any but the most superficial manner.

The work is a notable one, and must be on the working table of every ecologist and plant geographer. It is unfortunate, however, that the author has allowed his splendid classical training and love for Greek and Latin to carry him so far afield. The tendency nowadays is toward increasing emphasis on the vernacular, and it is to be feared that many of the author's best thoughts and most inspiring ideas will remain hidden among words.—HENRY C. COWLES.

Botany of the living plant

BOWER[3] has put into book form his course of lectures on elementary botany given at the University of Glasgow for more than 30 years. He gives a vivid picture of the plant as a living, growing, self-nourishing, self-adapting creature.

Of the 32 chapters, 18 are devoted exclusively to angiosperms, whose complete life activity is exhaustively treated from seed "germination" to seed dispersal. In the one chapter devoted to gymnosperms only the Scots pine is treated. This seems to the reviewer to be very inadequate treatment of such a fundamental group. In the two chapters assigned to Pteridophytes, only the Lycopodiales and Filicales are discussed. In the two chapters dealing with Bryophytes, students of this group will be surprised to learn that in Hepaticae the sporophyte, "except in the peculiar group Anthoceroteae, does not carry on photosynthesis." A statement concerning the ventilated structures of the gametophyte of Bryophytes is likely to mislead any but intimate students of the group: "In the sporophyte of vascular plants the typical photosynthetic organ is the leaf blade with its ventilated mesophyll and stomatal control. In the gametophyte of mosses and liverworts a similarly ventilated structure is seen in the leaves of the larger mosses and in the thallus-structure of the Marchantiales. These are, however, parts of the gametophyte, and the ventilated structure is here produced mainly by involution of the outer surface, while in vascular plants it arises from intercellular splitting of the cell walls. The physiological end is the same, in both cases, but the place and means are different. Plainly these are the results of parallel evolution, or homoplasy." Had the actual facts in Marchantiales been stated, the proof of homoplasy would have been absolute. Thallophytes are dealt with in 8 chapters. In the introductory chapter a statement widely applicable to all plant phyla is made: "It must not be assumed that all the organisms grouped under a common designation are necessarily akin to one another. . . . . Lines of descent are *divergent*, and the thallophytes would appear to represent a brush of phyletic lines radiating outwards from some simpler source." The chapter on sex and heredity is presented so clearly, so free from all verbiage, that beginners can easily grasp this subject, usually considered so complex. Likewise, the chapter on alternation of generations, the land habit, and the rise and fall of the gametophyte, is a masterpiece of lucid expression.

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[2] TANSLEY, A. G., The development of vegetation. Jour. Ecol. 4:198–204. 1916.

[3] BOWER, F. O., Botany of the living plant. 8vo, pp. x+580. *figs. 447.* Macmillan Co. 1919.

This text is the work of a man notable for brilliant research and also for exceptional power as a teacher. It is an example of the results obtained by a long period of first-hand contact with material as well as the presentation of these results to many generations of students.—W. J. G. LAND.

Forest products

As the utilization of plant products is a matter of interest to all botanists, a book discussing the use of wood and forest products, other than lumber, should find a place in all botanical libraries. The present volume[4] is attractive in appearance, well illustrated, and carefully organized. Some idea of its scope may be obtained from such chapter headings as the following: Wood pulp and paper, Tanning materials, Veneers, Slack and tight cooperage, Naval stores, Wood distillation, Charcoal, Boxes, Cross ties, Poles and piling, Mine timber, Fuel, Shingles, Maple syrup and sugar, Rubber, Dye woods, Excelsior and cork. Under each topic the character and source of the raw material,

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[4] BROWN, N. C., Forest products. 8vo. pp. xix+471. *figs. 120.* New York: Wiley & Sons. 1919. $3.75.